

CLAIMS

What is claimed is:

- 1 1. A circuit for generating a control signal for controlling the output power of a
2 power amplifier of a wireless device by comprising:
3 a power detector coupled to the output of the power amplifier for generating a detector
4 output signal; and
5 a variable gain amplifier coupled to the power detector for amplifying the detector output
6 signal to a desired level, wherein the value of the control signal generated by the
7 circuit is a function of the gain of the variable gain amplifier.
- 1 2. The circuit of claim 1, further comprising a conditioning circuit coupled to the
2 variable gain amplifier for conditioning an output of the variable gain amplifier, wherein
3 an output signal of the conditioning circuit is the control signal.
- 1 3. The circuit of claim 2, further comprising:
2 a sense circuit coupled to an output of the variable gain amplifier; and
3 an op amp having an output and first and second inputs, wherein the first input is coupled
4 to an output of the sense circuit and the second input is coupled to a reference
5 signal for creating a gain control signal at the output of the op amp.
- 1 4. The circuit of claim 3, wherein the reference signal is a DC signal.
- 1 5. The circuit of claim 3, wherein the gain control signal is used to control the gain
2 of the variable gain amplifier.

- 1 6. The circuit of claim 3, wherein the sense circuit is comprised of a first peak
2 detector.
- 1 7. The circuit of claim 6, further comprising a second peak detector coupled between
2 the reference signal and the second input of the op amp.
- 1 8. The circuit of claim 7, wherein the first and second peak detectors are matched.
- 1 9. The circuit of claim 3, wherein the reference signal is an RF signal.
- 1 10. The circuit of claim 1, wherein the power detector is comprised of a directional
2 coupler.
- 1 11. The circuit of claim 1, wherein the variable gain amplifier is comprised of a
2 multi-stage variable gain amplifier.
- 1 12. The circuit of claim 11, wherein the variable gain amplifier is comprised of six
2 stages.
- 1 13. The circuit of claim 11, wherein each stage of the variable gain amplifier is
2 controlled by the gain control signal.
- 1 14. The circuit of claim 1, wherein the wireless device is a cellular telephone.

1 15. The circuit of claim 1, wherein the power amplifier and the variable gain
2 amplifier reside together on an integrated circuit.

1 16. The circuit of claim 15, wherein the integrated circuit is a flip chip
2 semiconductor.

1 17. The circuit of claim 16, further comprising a ceramic chip carrier for carrying the
2 flip chip semiconductor, wherein one or more components of the circuit reside on the
3 ceramic chip carrier.

1 18. The circuit of claim 1, wherein the power amplifier further comprises:
2 a first switching device connected between a first supply voltage and a first output node;
3 a second switching device connected between a second supply voltage and a second
4 output node; and
5 an inductance coupled between the first and second output nodes.

1 19. A power detector for an RF power amplifier comprising:
2 a directional coupler for detecting RF power;
3 a variable gain amplifier having an input and an output, wherein the input is coupled to
4 the directional coupler;
5 a sense circuit coupled to the output of the variable gain amplifier for rectifying the
6 output of the variable gain amplifier;
7 an op amp for generating a gain control signal based on the rectified output of the sense
8 circuit and a reference signal, wherein the gain control signal is provided to the
9 variable gain amplifier to control the gain of the variable gain amplifier; and

10 conditioning circuitry for conditioning the gain control signal for use in controlling the
11 output power of the RF power amplifier.

1 20. The power detector of claim 19, wherein the RF power amplifier is a power
2 amplifier for a wireless communication device.

1 21. The power detector of claim 19, wherein the variable gain amplifier is comprised
2 of a plurality of variable gain amplifiers.

1 22. The power detector of claim 21, wherein the gain of each of the plurality of
2 variable gain amplifiers is determined by the gain control signal.

1 23. The power detector of claim 19, wherein the conditioning circuitry compensates
2 for the non-linearity of the variable gain amplifier.

1 24. The power detector of claim 19, further comprising a second sense circuit coupled
2 between the reference signal and the op amp.

1 25. The power detector of claim 24, wherein the level detector and the second sense
2 circuit are matched.

1 26. The power detector of claim 24, further comprising a variable limiter coupled
2 between the second sense circuit and the reference signal for limiting the value of the
3 reference signal to a predetermined value.

1 27. A method of controlling the output power of an RF power amplifier comprising
2 the steps of:
3 detecting the output power of the RF power amplifier and generating a first signal from
4 the detected output power;
5 amplifying the first signal using a variable gain amplifier;
6 generating a gain control signal from the output of the amplifier and from a reference
7 signal;
8 using the gain control signal to set the gain of the amplifier;
9 generating a second signal by conditioning the gain control signal; and
10 using the second signal to control the output power of the RF power amplifier.

1 28. The method of claim 27, wherein the amplifier is provided by a multi-stage
2 variable linear amplifier.

1 29. The method of claim 27, wherein the output power is detected using a directional
2 coupler.

1 30. The method of claim 27, wherein the gain control signal is generated by
2 comparing the amplified first signal to a reference signal.

1 31. The circuit of claim 1, wherein a gain control signal controls the gain of the
2 variable gain amplifier, the circuit further comprising a conditioning circuit for
3 generating the control signal, wherein the control signal is related to the reciprocal of the
4 gain control signal.

1 32. The circuit of claim 31, wherein the conditioning circuit further comprises:
2 a variable gain amplifier stage controlled by the gain control signal; and
3 sense circuitry combined with a feedback loop, wherein the conditioning circuitry forces
4 an input reference tone level to be equal to the control signal multiplied by the
5 gain of the variable gain amplifier stage.

1 33. An integrated circuit for use with an external directional coupler comprising:
2 an RF power amplifier formed on the integrated circuit, wherein the integrated circuit is
3 configured such that an external directional coupler can be used to generate a
4 detector signal based on the output power of the RF power amplifier; and
5 a power detector formed on the same integrated circuit to generate an output signal based
6 on the detector signal.

1 34. The method of claim 33, further comprising a ceramic chip carrier for carrying the
2 integrated circuit.

1 35. The method of claim 34, wherein the directional coupler is formed on the ceramic
2 chip carrier.

1 36. The method of claim 33, wherein the integrated circuit is used for a wireless
2 communication device.